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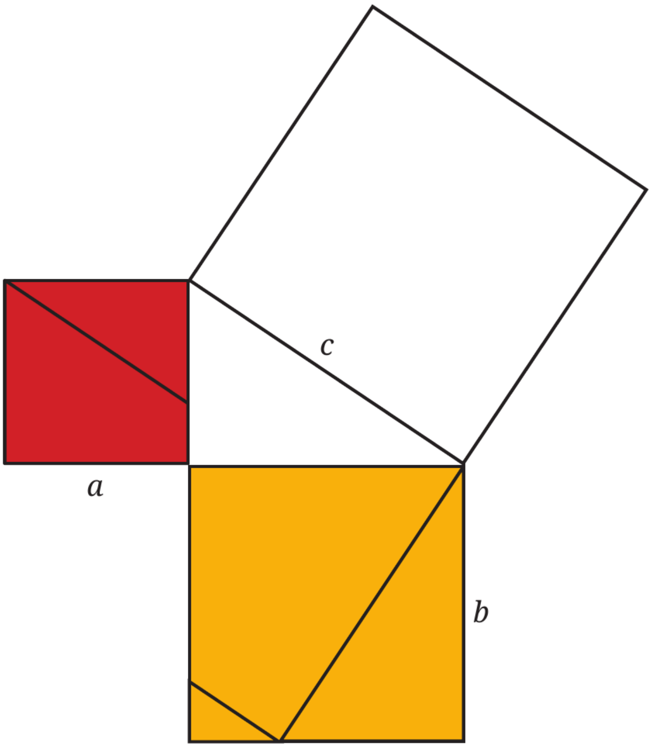
NCERT Notes for Class 8 Maths Part 2 (2026-27 Syllabus)

ncert class 8 maths notes chapter 2
The Baudhayana-Pythagoras Theorem



These ncert class 8 maths notes chapter 2 The Baudhayana-Pythagoras Theorem follow the Ganita Prakash Part 2 textbook for the 2026-27 session. You get every construction, every proof idea and every worked example in one place.

Also see for this chapter: **NCERT Solutions** | **Formula Sheet** | **Exemplar Solutions**

Contents

1 Doubling a Square

Chapter 2 opens with a question that is more than 2800 years old. Baudhayana, who wrote the Sulba-Sutra around 800 BCE, asked how to build a square with exactly double the area of a square you already have. His answer starts the whole chapter and leads straight to the theorem that carries his name.

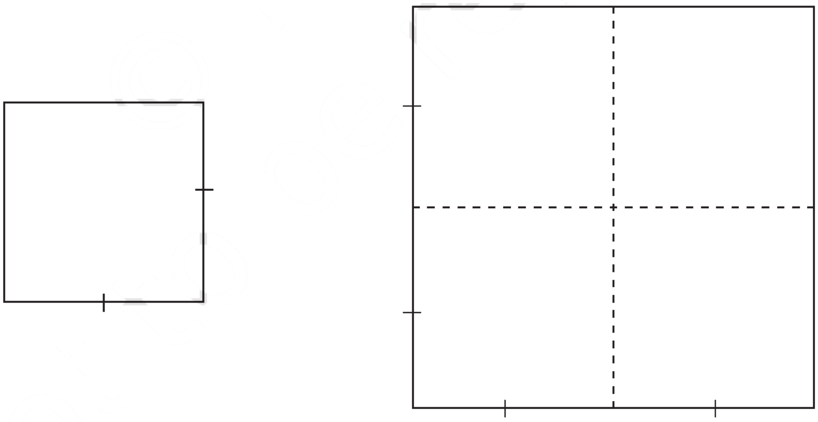
1.1 Why Doubling the Side Fails

The first guess most students make is to double the side. That guess is wrong, and seeing why is the first real idea of the chapter.

If the old square has side s, its area is s^2. Double the side and the new side is $2s$, so the new area is $(2s)^2 = 4s^2$.

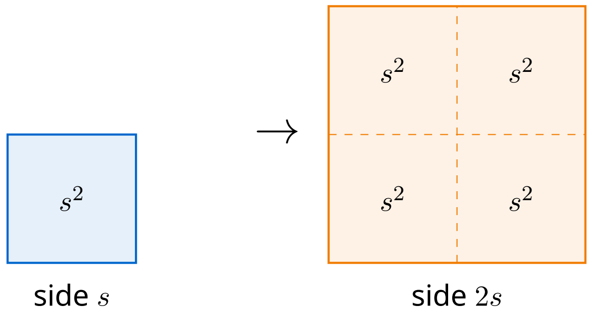
Side and Area Do Not Scale the Same Way

Side $\times 2 \implies$ Area $\times 4$ Side $\times k \implies$ Area $\times k^2$



Doubling the side of a square gives four times the area, not twice. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

The picture below shows the same fact with the doubled square split into four copies of the original.



Doubling the side is not doubling the area

Writing "area of new square $= 2s^2$" after doubling the side is the single most common slip in this chapter. Always square the new side first. Four small squares fit inside the doubled square, so the area goes up four times.

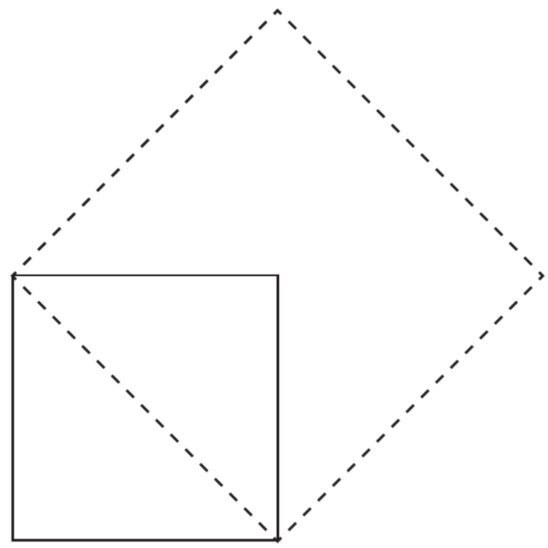
1.2 Baudhayana's Answer: Build on the Diagonal

Baudhayana's rule from Sulba-Sutra Verse 1.9 is short and exact. Read it once and the whole construction follows.

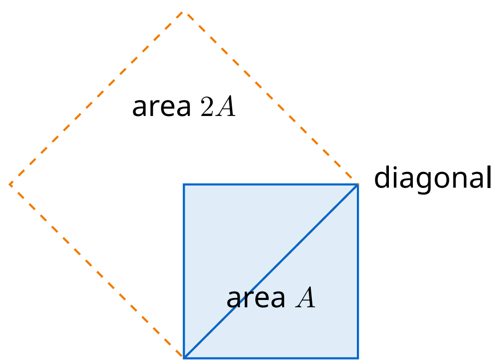
Sulba-Sutra, Verse 1.9

The diagonal of a square produces a square of double the area of the original square.

So you take the square you have, draw its diagonal, and build a fresh square on that diagonal. That new tilted square has exactly twice the area.



The square built on the diagonal of the original square. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

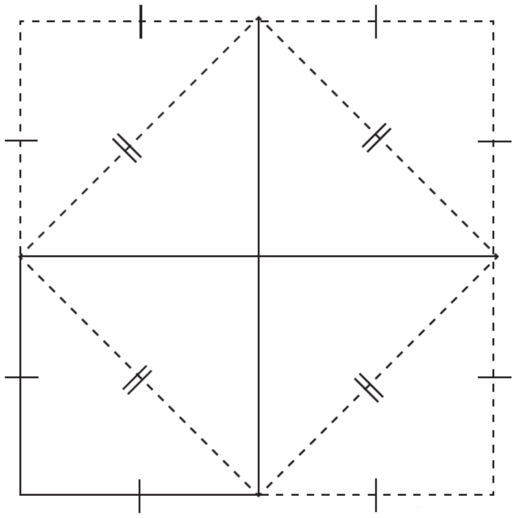


1.3 Why the Diagonal Square Is Exactly Double

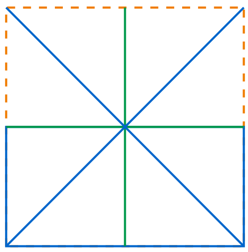
The proof needs no algebra at all. It only needs the horizontal and vertical lines that Baudhayana called east-west and north-south lines.

Draw those lines through the figure and both squares break into identical small right triangles. Count them.

- The original square is made of **2** small congruent triangles.
- The tilted square on the diagonal is made of **4** of the same triangles.
- So the tilted square has double the area. That is the whole argument.



East-west and north-south lines split both squares into congruent triangles. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.



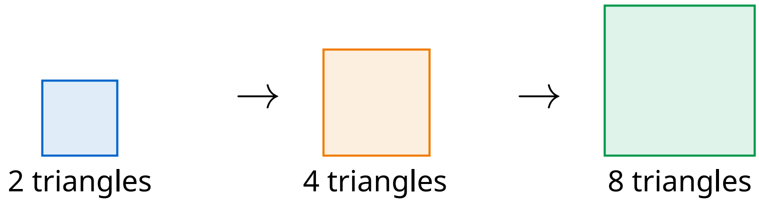
4 congruent triangles fill the tilted square

Count triangles, not lengths

Whenever a Class 8 question asks "why is this area double / half", look for a way to cut both shapes into the same small triangle. Counting equal pieces is faster and safer than measuring sides.

1.4 The Doubling Chain

Repeat the construction and you get a chain of squares where each one is twice the last.



Each square in this chain is built on the diagonal of the one before it. The triangle counts go 2, 4, 8, so the areas go A, $2A$, $4A$.

Vedic altars and brick counts

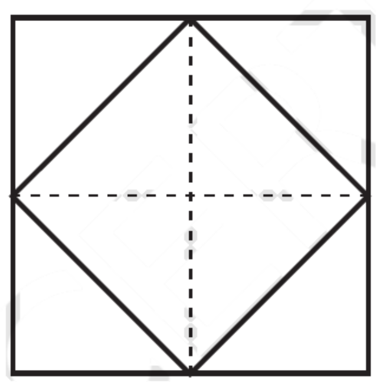
The Sulba-Sutra rules were written for building fire altars. Priests had to enlarge an altar without changing its shape, so they needed a square of exactly double the area. Baudhayana's diagonal rule gave masons a construction they could mark out with a rope on the ground.

2 Halving a Square

Once you can double a square, running the same idea backwards halves it. This short section is the mirror image of Section 1 and it prepares the exact figure used later to find the length of a diagonal.

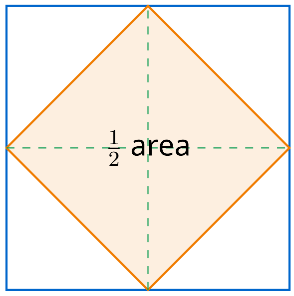
2.1 The Tilted Square Inside

Start with a square and join the midpoints of its four sides. The tilted square you get has half the area of the one you started with.



Joining midpoints gives an inner square of half the area. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

Adding the east-west and north-south lines again explains it in one line. The outer square splits into 8 congruent triangles and the inner tilted square holds 4 of them.



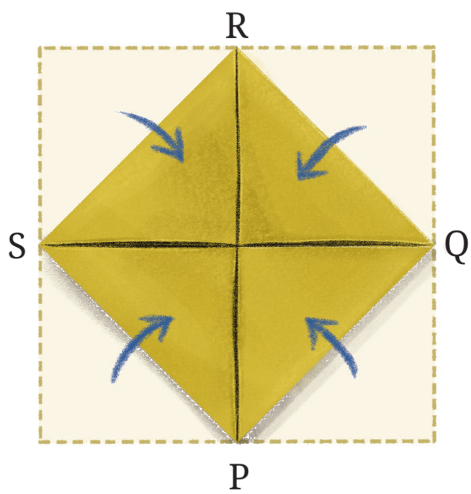
outer square: 8 triangles, inner square: 4

Halving Rule

Area of inner square $= \frac{1}{2} \times$ Area of outer square   Inner side $= \dfrac{\text{Outer side} \times \sqrt{2}}{2}$

2.2 Halving by Paper Folding

The textbook gives a hands-on version. Cut a square of paper, then fold all four corners inward so the crease lines pass through the midpoints of the sides. The square PQRS that shows up is the half-area square.



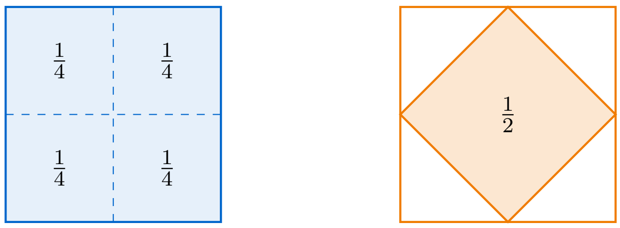
Folding the four corners inward produces square PQRS with half the area. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

Why is PQRS a square, and why is its area half? Join QS and PR. The four folded corner flaps are congruent right triangles, and together they cover exactly the same region as PQRS. So the paper splits into two equal parts.

- All four sides of PQRS are equal because the four flaps are congruent.
- Each angle of PQRS is $90°$, so PQRS is a square, not just a rhombus.
- The flaps fold in and cover PQRS with no gap and no overlap, so PQRS is half the sheet.

2.3 Half the Side Is Not Half the Area

This is the doubling mistake in reverse and it deserves its own line.



half the side gives one quarter of the area   the midpoint square gives one half

A square with half the side has area $\left(\frac{s}{2}\right)^2 = \frac{s^2}{4}$, so four of them fill the original. To get half the area you need the tilted midpoint square instead.

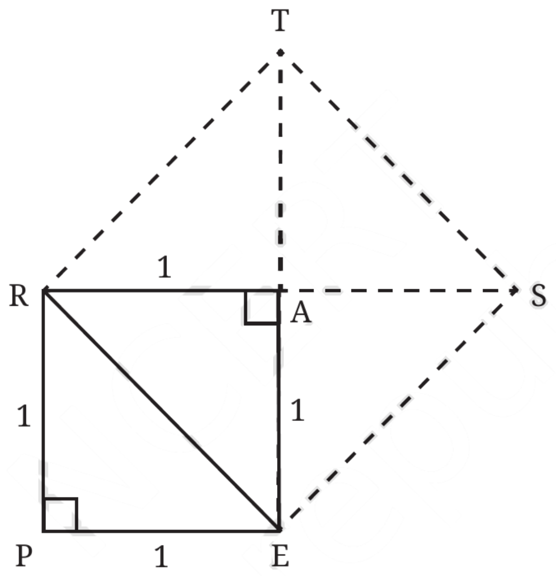
> **Double, Half, Diagonal**
>
> **"Diagonal doubles, midpoint halves."**
>
> Build *on* the diagonal and the area goes up two times. Join the *midpoints* and the area comes down to one half. Both moves change the side by a factor of $\sqrt{2}$.

3 The Hypotenuse of an Isosceles Right Triangle

In a right triangle the side facing the right angle is the hypotenuse. This section finds the hypotenuse of the simplest right triangle of all, the one with two equal short sides, and that hunt introduces the number $\sqrt{2}$.

3.1 Finding the Hypotenuse from an Area

Take an isosceles right triangle with both short sides of length 1. Two copies of it make a unit square PEAR. Now build the square REST on the hypotenuse ER.



Square REST is built on the hypotenuse ER of the unit square PEAR. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

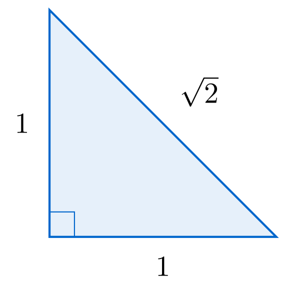
The square REST sits on the diagonal of PEAR, so by Section 1 it has double the area.

Hypotenuse of the Unit Isosceles Right Triangle

$$\text{Area of REST} = 2 \times \text{Area of PEAR} = 2 \times 1 = 2 \text{ sq. units}$$

$$c \times c = c^2 = 2$$

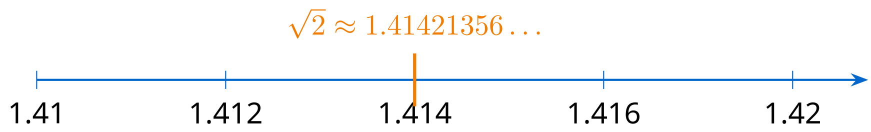
$$c = \sqrt{2}$$



3.2 How Big Is the Square Root of 2?

You cannot write $\sqrt{2}$ exactly as a decimal, but you can trap it between two decimals as tightly as you like. The textbook squeezes it step by step.

Step	Squares checked	Conclusion
Whole numbers	$1^2 = 1$, $2^2 = 4$	$1 < \sqrt{2} < 2$
One decimal	$1.4^2 = 1.96$, $1.5^2 = 2.25$	$1.4 < \sqrt{2} < 1.5$
Two decimals	$1.41^2 = 1.9881$, $1.42^2 = 2.0164$	$1.41 < \sqrt{2} < 1.42$
Three decimals	$1.414^2 = 1.999396$, $1.415^2 = 2.002225$	$1.414 < \sqrt{2} < 1.415$



Bounding without a calculator

To bound $\sqrt{N}$, hunt for two consecutive numbers whose squares straddle N. For $\sqrt{288}$, note $16^2 = 256$ and $17^2 = 289$, so $16 < \sqrt{288} < 17$. Board questions in this chapter almost always want a bound, not a long decimal.

3.3 Why the Decimal Never Ends

Suppose $\sqrt{2}$ had a terminating decimal, say it stopped at some non-zero last digit. Squaring a decimal that ends in a non-zero digit always gives a decimal that also ends in a non-zero digit. For example, a number ending in 4 squares to a number ending in 6.

But 2 written as a decimal is $2.000\ldots$, whose digits after the point are all zero. So no terminating decimal can square to 2, and the expansion of $\sqrt{2}$ must run on forever.

Key result

$\sqrt{2}$ has a non-terminating decimal expansion. Its first digits are $1.41421356\ldots$ and they never settle into a repeating block.

3.4 Why the Square Root of 2 Is Not a Fraction

Euclid gave this proof around 300 BCE and the textbook reproduces it. Suppose $\sqrt{2} = \dfrac{m}{n}$ for counting numbers m and n. Then

$$2 = \frac{m^2}{n^2} \qquad \Longrightarrow \qquad 2n^2 = m^2.$$

Now count how many times the prime 2 appears on each side.

- In any square number, every prime appears an **even** number of times.
- On the right, m^2 is a square, so 2 appears an even number of times.
- On the left, n^2 contributes an even count and the extra factor 2 makes it **odd**.

An even count cannot equal an odd count, so no such m and n exist.

A long decimal is not an exact value

Writing the square root of 2 as 1.414 in a final answer costs marks. Use 1.414 only when the question asks for an approximation. Otherwise leave the surd in place, or state the bounds:

$$1.41 < \sqrt{2} < 1.42.$$

3.5 The General Isosceles Right Triangle

Let both equal sides have length a and let the hypotenuse be c. The square on the hypotenuse is built on the diagonal of the square of side a, so it has double the area.

Isosceles Right Triangle Relation

$$c^2 = 2a^2 \quad \Longleftrightarrow \quad c = a\sqrt{2} \quad \Longleftrightarrow \quad a = \frac{c}{\sqrt{2}}, \quad a^2 = \frac{c^2}{2}$$

Example 1. Both equal sides measure 12 units. Find the hypotenuse.

$$c^2 = 2 \times 12^2 = 288, \qquad c = \sqrt{288}.$$

Since $16^2 = 256$ and $17^2 = 289$, the hypotenuse lies between 16 and 17 units.

Example 2. The hypotenuse is $\sqrt{72}$. Find the equal sides.

$$(\sqrt{72})^2 = 2a^2 \implies 72 = 2a^2 \implies a^2 = 36 \implies a = 6.$$

Each of the other two sides has length 6 units.

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4 Combining Two Different Squares

Sections 1 to 3 joined two squares of the *same* size. Baudhayana went further and solved the general problem: given two squares of any two sizes, build one square whose area is the sum of both. That construction is the theorem the chapter is named after.

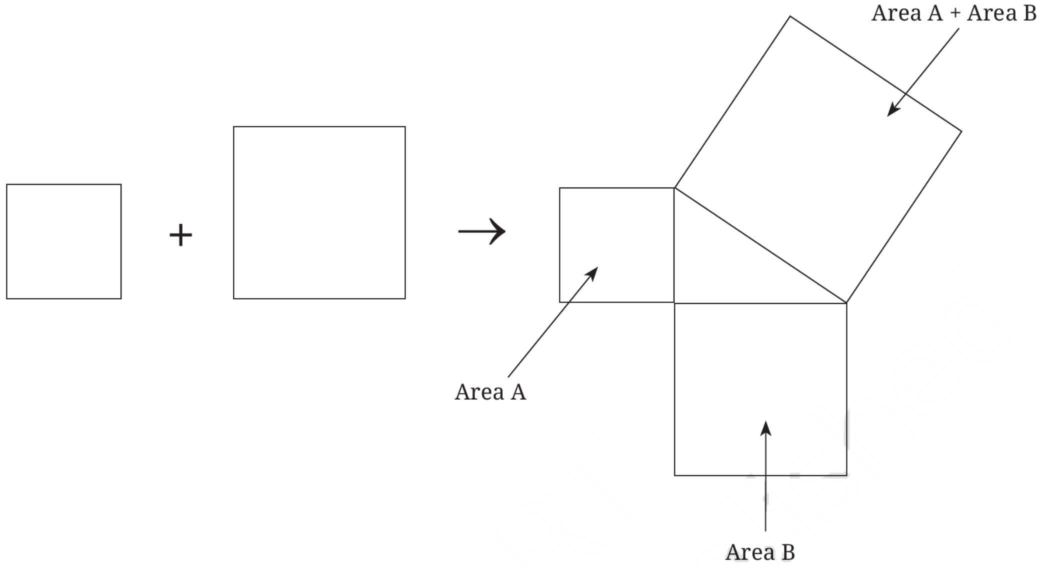
4.1 Baudhayana's Rule for Two Squares

Sulba-Sutra Verse 1.12 states the rule in one sentence.

Sulba-Sutra, Verse 1.12

The area of the square produced by the diagonal is the sum of the areas of the squares produced by the two sides.

In today's language: make a right-angled triangle whose two perpendicular sides equal the sides of the two given squares. The square on its hypotenuse has area equal to the sum of the two given squares.

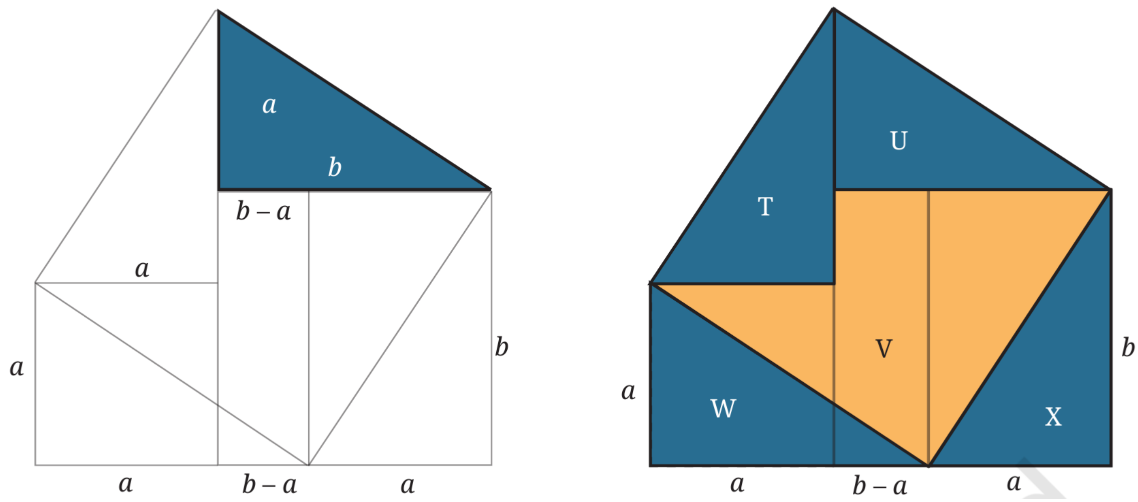


Two squares of different sizes combine into one square of area A + B. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

4.2 The Dissection Proof

Verse 2.1 explains why the rule works. Follow the four steps below with the textbook figure beside you.

1. **Join the two squares** of sides a and b along a common base line.
2. **Mark a rectangular strip** of the bigger square using the side of the smaller one, then draw its diagonal. This makes a right triangle with legs a and b.
3. **Draw three more copies** of that right triangle around the figure, so a 4-sided shape appears on the hypotenuse.
4. **Check the angles.** If one acute angle is x, the neighbouring one is $90° - x$, so every corner of the new shape is a right angle.

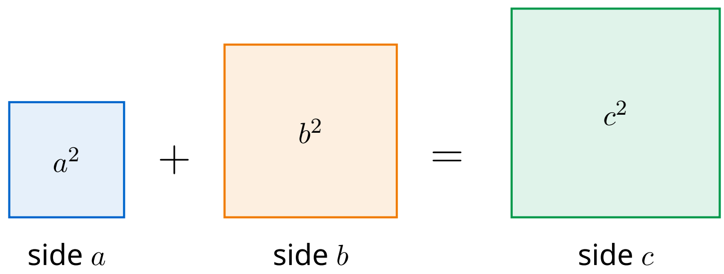


The pieces T, U, V, W and X show that the square on the hypotenuse equals the two smaller squares put together.

NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

Since T, U, W and X are congruent, all four sides of the new figure are equal, and all four angles are right angles, so it really is a square. Its side is the hypotenuse of the right triangle with legs a and b. Reading the areas twice gives the result:

$$\underbrace{T + U + V}_{\text{square on the hypotenuse}} = \underbrace{V + W + X}_{\text{the two given squares}} .$$

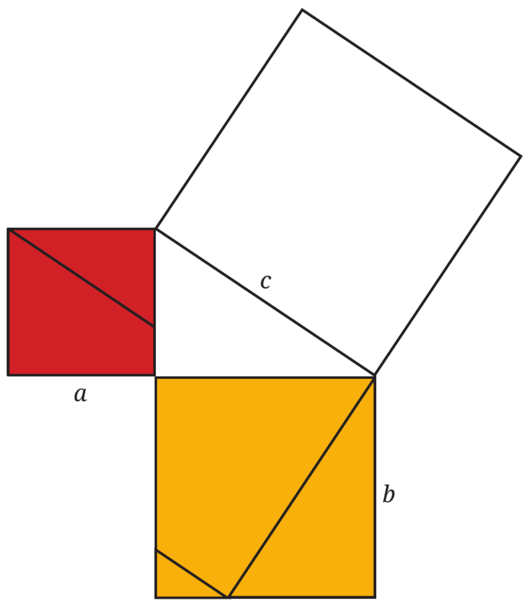


4.3 Statement of the Theorem

The Baudhayana-Pythagoras Theorem

If a right-angled triangle has sides a, b and c, where c is the hypotenuse, then

$$a^2 + b^2 = c^2.$$



The squares on the two legs together fill the square on the hypotenuse. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

Baudhayana was the first person on record to state this relation in full generality, around 800 BCE. Pythagoras, the Greek philosopher and mathematician, studied the same result about three hundred years later, near 500 BCE. The joint name Baudhayana-Pythagoras Theorem credits both traditions.

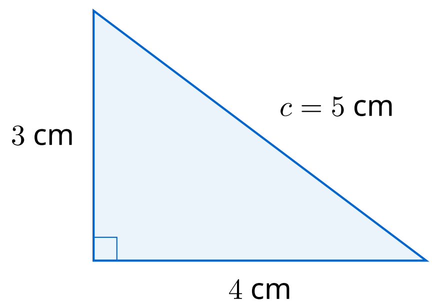
Carpenters, masons and the 3-4-5 rope

Builders still square up a room corner with a knotted rope: measure 3 units along one wall, 4 units along the other, and adjust until the diagonal reads exactly 5. Because $3^2 + 4^2 = 5^2$, that corner is a perfect right angle without any set square.

4.4 Using the Theorem

Draw a right triangle with legs 3 cm and 4 cm, then measure the hypotenuse. Your ruler says about 5 cm. The theorem says it is exactly 5 cm.

$$a^2 + b^2 = c^2 \implies 3^2 + 4^2 = c^2 \implies 9 + 16 = 25 \implies c = 5.$$



The same equation runs backwards to find a missing leg. If one short side is 8 cm and the hypotenuse is 17 cm, then

$$8^2 + b^2 = 17^2 \implies 64 + b^2 = 289 \implies b^2 = 225 \implies b = 15.$$

Put c on the correct side of the equation

$a^2 + b^2 = c^2$ works only when c is the hypotenuse. When the question gives you the hypotenuse and asks for a leg, you must *subtract*: $b^2 = c^2 - a^2$. Adding by habit turns 8 and 17 into $\sqrt{353}$ instead of the correct 15.

5 Right Triangles with Whole-Number Sides

Some right triangles have all three sides as whole numbers. Baudhayana listed several of them in Verse 1.13, and today they carry his name. This section shows how to spot them, how to build new ones from old ones, and how to generate fresh ones from odd square numbers.

5.1 What Is a Baudhayana Triple?

A triple (a, b, c) of positive integers with $a^2 + b^2 = c^2$ is called a Baudhayana triple. The same set is also called a Baudhayana-Pythagoras triple or a Pythagorean triple.

Triple	Check	Primitive?
$(3, 4, 5)$	$9 + 16 = 25$	Yes
$(5, 12, 13)$	$25 + 144 = 169$	Yes
$(8, 15, 17)$	$64 + 225 = 289$	Yes
$(7, 24, 25)$	$49 + 576 = 625$	Yes
$(12, 35, 37)$	$144 + 1225 = 1369$	Yes
$(15, 36, 39)$	$225 + 1296 = 1521$	No, common factor 3

Baudhayana listed all six of these more than 2500 years ago.

Learn five triples by heart

$(3, 4, 5)$, $(5, 12, 13)$, $(8, 15, 17)$, $(7, 24, 25)$ and $(20, 21, 29)$ cover most school questions. If a problem gives two of these numbers, the third one is the answer and no square root work is needed.

5.2 Scaled Triples

Multiply every member of a triple by the same positive integer k and you get another triple. The proof is two lines of algebra.

$$\begin{aligned}(ka)^2 + (kb)^2 &= k^2a^2 + k^2b^2 \\ &= k^2\left(a^2 + b^2\right) \\ &= k^2c^2 = (kc)^2.\end{aligned}$$

So $(3, 4, 5)$ grows into $(6, 8, 10)$, $(9, 12, 15)$, $(12, 16, 20)$ and onwards without end.

$$\begin{tikzcd} & (6,8,10) & \\ (3,4,5) \arrow[ur, "k=2"] \arrow[r, "k=3"] \arrow[dr, "k=4"'] & (9,12,15) & \text{infinitely many} \\ & (12,16,20) & \end{tikzcd}$$

Primitive triples

A triple whose three numbers share no common factor greater than 1 is called **primitive**. So $(3, 4, 5)$ and $(5, 12, 13)$ are primitive, while $(9, 12, 15)$ is not, since 3 divides all three. Every Baudhayana triple is either primitive or a scaled copy of a primitive one.

Going the other way also works. If (a, b, c) share a common factor f greater than 1, then $\left(\frac{a}{f}, \frac{b}{f}, \frac{c}{f}\right)$ is again a triple. Dividing $(9, 12, 15)$ by 3 returns $(3, 4, 5)$.

5.3 Building Triples from Odd Squares

Here is the generating trick the textbook uses. It rests on a fact you met in earlier classes: the sum of the first n odd numbers is n^2.

$$\begin{aligned} 1 &= 1^2 \\ 1 + 3 &= 2^2 \\ 1 + 3 + 5 &= 3^2 \end{aligned}$$

The nth odd number is $2n - 1$, so splitting the last term off gives

Triple Generator

$$(n-1)^2 + (2n-1) = n^2$$

Whenever the odd number $2n - 1$ is itself a perfect square, this line becomes a Baudhayana triple.

Worked case 1. Take the odd square 9. Since $9 = 2 \times 5 - 1$, we have $n = 5$:

$$(5-1)^2 + 9 = 5^2 \implies 4^2 + 3^2 = 5^2.$$

Worked case 2. Take the odd square 25. Since $25 = 2 \times 13 - 1$, we have $n = 13$:

$$(13-1)^2 + 25 = 13^2 \implies 12^2 + 5^2 = 13^2.$$

Odd square $2n-1$	n	**Triple**	**Check**
9	5	$(3, 4, 5)$	$9 + 16 = 25$
25	13	$(5, 12, 13)$	$25 + 144 = 169$
49	25	$(7, 24, 25)$	$49 + 576 = 625$
81	41	$(9, 40, 41)$	$81 + 1600 = 1681$
121	61	$(11, 60, 61)$	$121 + 3600 = 3721$
169	85	$(13, 84, 85)$	$169 + 7056 = 7225$

Notice the pattern in the table: in every triple made this way, the larger leg is exactly one less than the hypotenuse. That is why the method never produces a non-primitive triple, and also why triples like $(8, 15, 17)$ and $(20, 21, 29)$ cannot come out of it.

Odd square, half step, done

"Odd square $\rightarrow$ add one $\rightarrow$ halve $\rightarrow$ that is n."

For the odd square 49: $49 + 1 = 50$, half of 50 is 25, so $n = 25$. The triple is $(7, 24, 25)$, using $\sqrt{49} = 7$ and $n - 1 = 24$.

6 Fermat's Last Theorem

The list of whole-number solutions of $a^2 + b^2 = c^2$ never ends. In the 17th century the French mathematician Pierre de Fermat asked what happens if the power 2 is replaced by 3, 4 or anything larger. His guess became one of the most famous unsolved problems in mathematics.

6.1 From Squares to Higher Powers

Fermat wondered whether the equation

$$x^n + y^n = z^n$$

has any solution in natural numbers when $n > 2$. Is there a perfect cube that equals the sum of two perfect cubes? A fourth power that equals the sum of two fourth powers?

$x^2 + y^2 = z^2$ has endless solutions

↓

$x^n + y^n = z^n,\ n > 2$ has none

raise the power past 2 and every solution disappears

Fermat wrote his claim in the margin of a book on number theory, adding a famous sentence: he had found a truly marvellous proof, but the margin was too small to contain it. No trace of that proof was ever found.

6.2 Three Centuries and Andrew Wiles

After Fermat's death, one great mathematician after another attacked the problem. More than 300 years of attempts failed.

1637	1963	1994
Fermat writes the margin note	Wiles reads about it, aged 10	Wiles completes the proof

In 1963 a ten-year-old English boy named Andrew Wiles read a library book about the problem and decided he would solve it. He did, in 1994, more than thirty years later.

A school library book that changed mathematics

Wiles picked up *The Last Problem* by Eric Bell from his local library at the age of 10. The proof he finally wrote uses mathematics far beyond Class 8, but the starting point was the very equation you have been solving in this chapter.

7 Applications of the Theorem

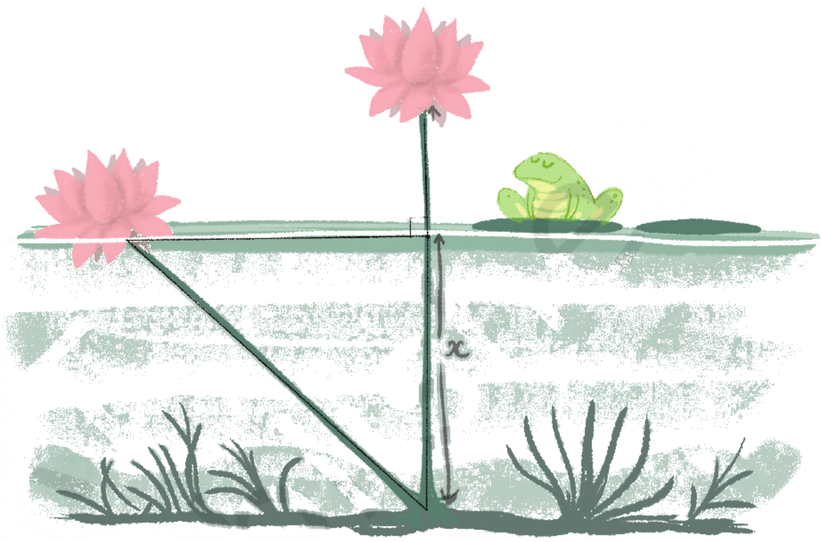
The Baudhayana-Pythagoras theorem is one of the most useful results in all of geometry. Any time a problem hides a right angle, the theorem turns two known lengths into the third. This section works through the classic applications, starting with a 12th century puzzle.

7.1 The Lotus Problem from Lilavati

Bhaskaracharya set this problem in his book Lilavati around 1150 CE.

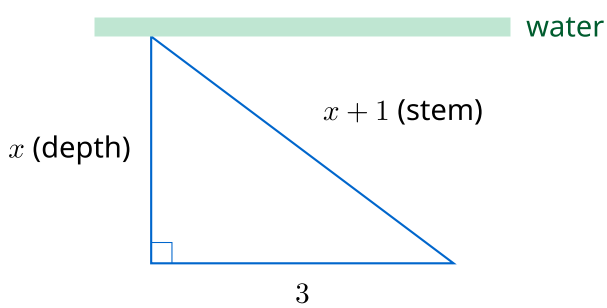
The problem

In a lake, a lotus stands 1 unit above the water. A breeze pushes it over until the tip just touches the water 3 units away from where it started. Find the depth of the lake.



The lotus, the lake and the swaying stem. NCERT Ganita Prakash, Class 8 Part 2, Chapter 2.

Let x be the length of stem under water, which is the depth of the lake. The stem sticks 1 unit above the surface, so the whole stem is $x + 1$. When it bends over, that same stem becomes the hypotenuse of a right triangle with legs 3 and x.



$$\begin{aligned} 3^2 + x^2 &= (x+1)^2 \\ 9 + x^2 &= x^2 + 2x + 1 \\ 9 &= 2x + 1 \\ x &= 4 \end{aligned}$$

The lake is 4 units deep. Notice how the x^2 terms cancel, which is why the puzzle looks like it has too little data but does not.

When the unknown appears on both sides

If the hypotenuse is written as $x+k$ and a leg as x, expand $(x+k)^2$ and cancel x^2. What remains is a simple linear equation. This trick solves every "ladder against a wall" and "bamboo broken by wind" problem.

7.2 Diagonals of Squares and Rectangles

A diagonal cuts any rectangle into two right triangles, so the theorem gives the diagonal at once.

Diagonal Formulas

Square of side s : $d = s\sqrt{2}$ Rectangle $\ell \times b$: $d = \sqrt{\ell^2 + b^2}$

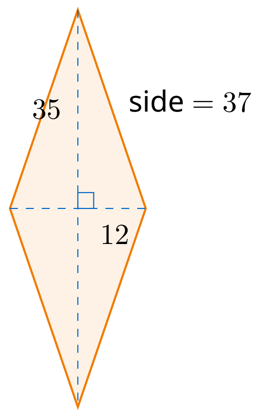
Worked example. The diagonal of a square of side 5 cm is $5\sqrt{2}$ cm, which lies between $5 \times 1.41 = 7.05$ cm and $5 \times 1.42 = 7.10$ cm.

A rectangle whose sides and diagonal are all whole numbers is just a Baudhayana triple in disguise. Five easy ones are listed below.

Length	Breadth	Diagonal
4	3	5
12	5	13
15	8	17
24	7	25
35	12	37

7.3 The Side of a Rhombus

The diagonals of a rhombus cut each other in half at right angles. So each side of the rhombus is the hypotenuse of a right triangle whose legs are the half-diagonals.

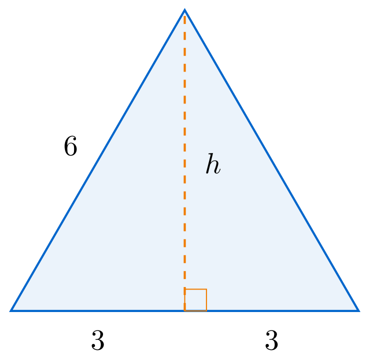


Worked example. A rhombus has diagonals 24 units and 70 units. Half of each is 12 and 35, so

$$\text{side} = \sqrt{12^2 + 35^2} = \sqrt{144 + 1225} = \sqrt{1369} = 37 \text{ units.}$$

7.4 Height and Area of an Equilateral Triangle

In an equilateral triangle, the altitude from any vertex bisects the opposite side. That gives a right triangle with hypotenuse s and one leg $\frac{s}{2}$.



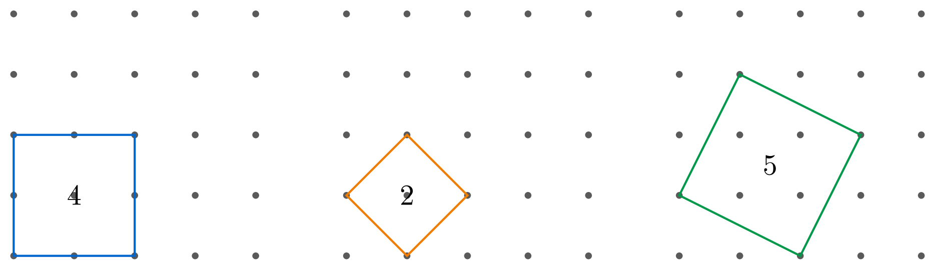
Worked example. For a side of 6 units,

$$h^2 + 3^2 = 6^2 \implies h^2 = 36 - 9 = 27 \implies h = \sqrt{27} = 3\sqrt{3}.$$

$$\text{Area} = \tfrac{1}{2} \times 6 \times 3\sqrt{3} = 9\sqrt{3} \approx 15.59 \text{ sq. units.}$$

7.5 Squares on a Dot Grid

On a square dot grid you can draw tilted squares as well as upright ones. The area of a tilted square whose side runs p steps across and q steps up is $p^2 + q^2$, straight from the theorem.



Areas of $1, 2, 4, 5, 8, 9, 10, 13, \ldots$ are all reachable. An area of 3 is not, because 3 cannot be written as $p^2 + q^2$ with whole numbers p and q.

The hypotenuse is always the longest side

Some students label the longest given number as a leg. In every right triangle, $c^2 = a^2 + b^2 > a^2$, so $c > a$ and $c > b$. The side opposite the right angle is always the longest. Check this before you plug numbers in.

8 Worked Examples and Exam Practice

This section gathers the question types that appear most often in Class 8 tests on this chapter. Work through them with a pencil before reading each solution.

8.1 Solved Examples

Example 3. A right triangle has legs 9 and 12. Find the hypotenuse.

$$c^2 = 9^2 + 12^2 = 81 + 144 = 225 \implies c = 15.$$

This is $(3, 4, 5)$ scaled by 3.

Example 4. A right triangle has a leg 9 and hypotenuse 15. Find the other leg.

$$b^2 = 15^2 - 9^2 = 225 - 81 = 144 \implies b = 12.$$

Example 5. Legs are 7 and 12. Find the hypotenuse, correct to one decimal place.

$$c^2 = 49 + 144 = 193, \qquad 13^2 = 169,\ 14^2 = 196 \implies 13 < c < 14.$$

Refining: $13.8^2 = 190.44$ and $13.9^2 = 193.21$, so $c \approx 13.9$.

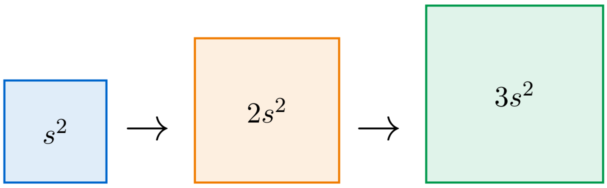
Example 6. Legs are 1.5 and 3.5. Find the hypotenuse.

$$c^2 = 2.25 + 12.25 = 14.5, \qquad 3.8^2 = 14.44,\ 3.9^2 = 15.21 \implies c \approx 3.8.$$

Example 7. An isosceles right triangle has hypotenuse 10. Find the equal sides.

$$c^2 = 2a^2 \implies 100 = 2a^2 \implies a^2 = 50 \implies a = \sqrt{50} = 5\sqrt{2} \approx 7.07.$$

Example 8. Build a square whose area is three times a given square of side s. Start with the square of side s. Build the doubling square on its diagonal, which has area $2s^2$ and side $s\sqrt{2}$. Now make a right triangle with legs $s\sqrt{2}$ and s. The square on its hypotenuse has area $2s^2 + s^2 = 3s^2$. Repeating the step gives four times, five times, and so on.



8.2 Common Mistakes and How to Avoid Them

Mistake	Fix
Doubling the side to double the area	Build on the diagonal instead. Doubling the side gives four times the area.
Adding when the hypotenuse is known	Subtract: $b^2 = c^2 - a^2$.
Writing $\sqrt{2} = 1.414$ as an exact value	Keep the surd, or state bounds such as $1.41 < \sqrt{2} < 1.42$.
Forgetting to take the square root at the end	The equation gives c^2. The answer is c.
Using half a diagonal as a full side in a rhombus	Diagonals bisect each other, so use $\frac{d_1}{2}$ and $\frac{d_2}{2}$.
Calling $(9, 12, 15)$ primitive	Divide by the common factor 3 first.

A 15-second check on every answer

The hypotenuse must be longer than each leg but shorter than their sum. For legs 5 and 12, the answer must sit between 12 and 17. Anything outside that range is wrong, so recheck before moving on.

8.3 Question Trends in School Tests

Question type	Usual marks	What to revise
Find the missing side of a right triangle	1 to 2	Standard triples, $c^2 = a^2 + b^2$
Find the diagonal of a square or rectangle	2	$d = s\sqrt{2}$, $d = \sqrt{\ell^2 + b^2}$
Bound a square root between two decimals	2	Squeezing method from Section 3
Isosceles right triangle, given a or c	2 to 3	$c^2 = 2a^2$
Side of a rhombus from its diagonals	3	Half-diagonals form a right triangle
Lotus, ladder or bamboo word problem	3 to 4	Expand $(x + k)^2$ and cancel x^2
Generate or test Baudhayana triples	3	$(n - 1)^2 + (2n - 1) = n^2$
Explain why a construction doubles or halves an area	3 to 4	Congruent-triangle counting

SASH for word problems

Sketch the picture, **A**sk where the right angle is, **S**ubstitute into $a^2 + b^2 = c^2$, **H**unt for the square root last. Following SASH in order stops most careless errors in 3-mark and 4-mark questions.

9 Quick Reference Summary

Everything in Chapter 2 fits on the next two pages. Use this section the night before a test, then go back to the worked examples for practice.

9.1 Formula Sheet

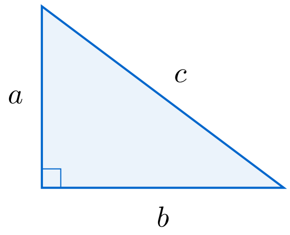
All Chapter 2 Formulas

Baudhayana-Pythagoras theorem:	$a^2 + b^2 = c^2 \quad$ (c is the hypotenuse)
Missing leg:	$b = \sqrt{c^2 - a^2}$
Isosceles right triangle:	$c^2 = 2a^2, \qquad c = a\sqrt{2}$
Diagonal of a square:	$d = s\sqrt{2}$
Diagonal of a rectangle:	$d = \sqrt{\ell^2 + b^2}$
Side of a rhombus:	$s = \sqrt{\left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2}$
Height of an equilateral triangle:	$h = \dfrac{s\sqrt{3}}{2}$
Area of an equilateral triangle:	$A = \dfrac{\sqrt{3}}{4}s^2$
Triple generator:	$(n-1)^2 + (2n-1) = n^2$
Scaling a triple:	$(a, b, c) \Rightarrow (ka, kb, kc)$

9.2 Numbers Worth Memorising

Quantity	**Value**
$\sqrt{2}$	$1.41421356\ldots$, and $1.414 < \sqrt{2} < 1.415$
$\sqrt{3}$	$1.7320508\ldots$
Primitive triples up to 40	$(3,4,5)$, $(5,12,13)$, $(8,15,17)$, $(7,24,25)$, $(20,21,29)$, $(9,40,41)$
Baudhayana's own list	$(3,4,5)$, $(5,12,13)$, $(8,15,17)$, $(7,24,25)$, $(12,35,37)$, $(15,36,39)$
Squares to remember	$11^2 = 121$, $12^2 = 144$, $13^2 = 169$, $15^2 = 225$, $17^2 = 289$, $25^2 = 625$

9.3 One-Page Recap Diagram

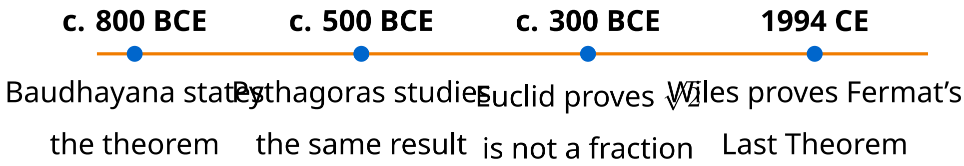


$a^2 + b^2 = c^2$

c is always the longest side

equal legs give $c = a\sqrt{2}$

9.4 Timeline of the Theorem



9.5 Final Revision Checklist

- I can explain why doubling a side gives four times the area.
- I can build a square of double the area on a diagonal, and say why it works.
- I can build a square of half the area by joining midpoints.
- I can prove $c^2 = 2a^2$ for an isosceles right triangle.
- I can bound $\sqrt{2}$ between two decimals with three decimal places.
- I can state and apply $a^2 + b^2 = c^2$ in both directions.
- I can list six Baudhayana triples and say which are primitive.
- I can generate new triples from odd square numbers.
- I can solve the lotus problem and other word problems with a hidden right angle.
- I can state Fermat's Last Theorem and say who proved it, and when.

Where you meet this next

Class 9 uses this theorem for coordinate geometry distance, Class 10 uses it for trigonometry and similar triangles, and Class 11 uses it for circles and conic sections. The two-line result you learned here carries all the way through school geometry.

Related Collegedunia Resources

Same chapter, other resources:

- NCERT Solutions
- Formula Sheet
- NCERT Book PDF
- Exemplar Book PDF
- Exemplar Solutions
- Handwritten Notes

Continue learning:

- Ch 1: Fractions in Disguise
- Ch 3: Proportional Reasoning-2
- Class 8 Maths - All Chapters